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THE VARIABILITY OF CORRESPONDING SEASONS IN DIFFERENT YEARS.

BY SIR FREDERIC STUPART.

A PROBLEM which still remains unsolved in Meteorology is why corresponding seasons in different years differ so much in character. In a previous paper* entitled "Is the Climate Changing" the various conditions in nature which lead to the distinctive features of the climatic zone were given as follows:

1. Distance from the equator.
2. Geographical position in relation to land and sea.
3. Altitude.
4. The prevailing winds, the outcome of a general atmospheric circulation.

It was pointed out that of the factors enumerated, distance from the equator, distance from the sea, and altitude were, in short periods of history, constants, and that unless deforestation could be shown to have had an appreciable effect, we are thrown back to the assumption that climatic variations through comparatively short periods of history must result from changes in atmospheric circulation, which changes must be further investigated.

*This JOURNAL, **17**, 197, 1917.

If to variation in the atmospheric circulation are due the pulsations in climate which we know have occurred down through the centuries and in our own time, how much more certain is it that the variations from year to year are attributable to a somewhat similar cause?

The question to be considered then is—apart from the constant factors which produce the distinctive characteristics of the climatic zones—what are the more direct varying conditions which lead to abnormalities and is it possible to account for these changing conditions?

The past two winters, that of 1918 and that of 1919, were in strong contrast; the former was phenomenally cold and the latter phenomenally mild. Why the difference?

It will be in order to describe what may perhaps be termed the normal distribution of atmospheric pressure, and then show in what respect the distribution of atmospheric pressure in these two years has differed from normal and led to unusual air movements.

Observations on the surface of the earth and of the atmospheric currents, as indicated by clouds and the ballon-sonde, indicate a primary distribution of atmospheric pressure and a general air circulation about as follows:

A belt of low pressure around the globe in the equatorial regions; both northward and southward the pressure increases towards a belt of high pressure between 25° and 30° north and south latitude and the outcome of this distribution is the northeast and southeast trade winds of the tropics. As the latitude increases beyond the high pressure belts, the pressure gradually diminishes and the barometric gradient of the middle and higher latitudes produces the prevalent westerly winds. If the globe were all land or all water this distribution of atmospheric pressure, and hence the winds, would probably be almost constant and simply fluctuate somewhat in latitude with the annual change in the sun's declination.

But the earth is part land and part water and the very different absorptive and radiating properties of land and water lead to a secondary atmospheric distribution which changes with the seasons and is impressed on the primary system. In the colder seasons over the continents, the high pressure of the primary belts becomes

higher and in both the eastern hemisphere and the western hemisphere overspreads towards higher latitudes, while in the warmer seasons the high pressure either diminishes or disappears and low pressure takes its place.

As far as is known the great cold waves which form over the northern parts of the continents in winter are the outcome of the radiation of heat from the land, and lead to anticyclonic conditions. In normal seasons the anticyclones and cold waves thus formed in the north, move southeastward to lower latitudes, alternating with but outbalancing the low areas which move eastward, carried with the general drift of the primary system of circulation.

The mean barometric charts show how the resultant of atmospheric changes and movements is high pressure over the continents in winter while in the North Pacific and North Atlantic the barometer is low. These low centres have been termed centres of action.

But a study of monthly charts of single winters shows a marked variation in the contrast between the continental high pressure and the ocean low. In some winters in Canada, it is high pressure in northern latitudes which dominates our weather, while in other winters the continental high seems to be overpowered by the Pacific low which most persistently in the form of deep cyclonic areas prevents the formation of anticyclones over Yukon and the Mackenzie River Basin, and the result is the formation of barometric gradients which produce a general flow of air from south to north over Canada and hence higher temperature than the normal.

In the early part of the winter of 1917-18 the anticyclonic type was more pronounced than in any other winter on record, and with most persistent areas of high barometer coming in over Yukon, perhaps indeed offshoots from the great Siberian winter anticyclone, the North Pacific low pressure was situated much further south than usual and its offshoots, in the form of travelling low areas passed into Canada over southern British Columbia and thence kept away to the southward, and the result was a prevalence of northerly winds, not only in the western provinces but also in Eastern Canada.

During the winter just closed we find conditions in strong contrast to those of the previous year; the North Pacific low was

extremely energetic and in a stream of offshoot cyclonic areas which impinged on the northern Alaskan coast, prevented the formation of anticyclonic conditions, and passing first southeastward, finally moved eastward as dispersing areas across the western provinces, there giving most persistent gradients for southerly and southwesterly winds with unseasonably high temperature. I shall not go into details regarding the various months, contenting myself with this general outline.

The problem which has then first to be solved would appear to be that concerning the centres of action in the North Pacific and North Atlantic—why in some years so much more pronounced than in others?

An important point will be—what conditions appear most favourable for the development of low areas? In an address before the Royal Society of Canada in 1914 the writer said, "We do know, however, something of the conditions which are very obviously connected with the development of cyclones, perhaps indeed we have more certain knowledge regarding this than of any other meteorological activity, *e.g.*, in the colder seasons when cold continental winds in the rear of a shallow trough of low pressure reach the coast line of the Gulf of Mexico or the middle Atlantic, there is almost certain to be a marked storm development, with heavy precipitation. Moist warm air of the Gulf Stream on the one side and cold continental air on the other, lead to a rapid cyclonic development and the greater the contrast in temperature, the more pronounced will be the storm". It is clear that warm moist air is a most important factor, and the warmer and moister it is, the better are the conditions for cyclonic development.

The writer believes that the time now is when increased investigation should be carried on regarding the changes, both in the position and temperatures of the great ocean currents. If it can be shown that the great Japan current in some years carries its warm waters further north than in other years, it may not improbably be subsequently shown that in such years cyclonic conditions are more intense near the Alaskan coast, and we shall at once have valuable information regarding the probable distribution of barometric pressure in Northwestern America, and this appears to be a dominating factor in the character of our winter seasons.

In the bulletin of the Scripps Institution for biological research of the University of California, November 8th, 1918, Mr. Geo. F. McEwen reviews the various theories of the cause of oceanic circulation from ancient times to the present and urges concerted action by the governments in a survey of the ocean currents and their variation in position in different years.

While it would appear probable that conditions that would increase the temperature and the flow of ocean currents would act simultaneously in both hemispheres, it does not necessarily follow that the effect on the northern coast of Europe would occur simultaneously with the effect on the northwest coast of America. One would surmise that as the source of the Gulf Stream is nearer the British Isles than is the source of the Japan current to Alaska that Europe would be affected before America and quite possibly this is the case. The whole question is complex but well worthy of study.

METEOROLOGICAL OFFICE, TORONTO.

COPERNICUS.

By Albert Durrant Watson.

WHEN the merchants of northern Europe heard that Captain Columbus, a sailor of Genoa, had found a western sea-road to India, they feared the failure of their trade in the markets of Spain as a result of the inflow of products from the new Eldorado. One youth of twenty-one years viewed the discovery from a different angle. He had recently returned from Krakau (Cracow) where, under the inspiring tuition of Albert Brudzewski (1445-1497), his studies in mathematics had given him new and permanent impulse and direction, and fitted him for his astronomical career.

This youth was Nocolai Koppernigk, or as we know him, Nicholas Copernicus (1473-1543). He saw that the most effective bar to the world's progress was not the ocean vastness, nor the threat of the hurricane that drives the courageous ship to its doom. He perceived that, though the mind is man's greatest instrument of freedom, yet in the mind are man's real barriers. The fixed idea, the closed incident, imitation that kills initiative action, the unchangeable creed and the unoriginal method,—these he recognized as our most insuperable limitations,—in a word, those self-paralyzing mental attitudes of inertia, ultra-conservatism, fear and skepticism which lure the indolent to Circean Isles of unreality.

Ptolemy, a learned Alexandrian of the second century, as interpreted by Johann Müller of Königsberg, (1436-1476) (or, as he styled himself, Joannes de Monteregio, but now known as Regiomontanus), was the acknowledged authority in that world that Copernicus knew, in all things astronomical. From a very early date in the career of the young mathematician, he distrusted the findings of his mathematical mentors. He was not willing to accept the poetry of the Scriptures,

> "The earth also is established that it cannot be moved,"

as the working principle in the science of a new age. The heavens were telling him a different story from which a poetry of even more sublime significance would yet be inspired.

Was Nicholas Copernicus a Teuton or a Slav, a German or a Pole? His father was a Pole, his mother a German. His allegiance was Polish, his language was German. A German citizen, but a Polish subject, his education was cosmopolitan. As Shakespeare was "not of an age but of all time," so Copernicus was not of one race only, but of all humanity.

Born February 19, 1473, in the fortress town of Thorn, one of the bridge-heads of the Vistula in Prussian Poland, Copernicus was destined by his father for a commercial career, but Destiny itself intervened, the father died when his boy was only ten years of age, and his mother's brother, Lucas Watzelrode, became the faithful, wise and efficient guardian of Nicolai and his elder brother Andreas.

Lucas Watzelrode was an eminent scholar, having studied at the universities of Cracow, Leipsic and Prague. In his guardianship of the young Koppernigks, their mother's dearest hope was realized. She rightly esteemed her brother, rising, as he was, through his scholarship, to eminence and great influence, as a most desirable foster-father of the orphaned boys. This feeling was greatly strengthened when, six years later, he was advanced to the vacant Bishopric of Ermland.

At the university of Cracow (1491-1494), Copernicus had probably the best mathematical teacher in Northern Europe. But eminent as was the teacher, the scholar was far greater, and to-day we hear of Brudzewski only because, over four hundred years ago, for three seasons, he had for a scholar, a boy named Nicolai Koppernigk.

For leisure, Copernicus, at this time, practised drawing, and even made a portrait of himself, using a mirror the while to demonstrate his subject. This portrait was preserved for many years, by those who cherished his memory and his fame, but it perished long ago with many other important matters pertaining to his life and fortunes. Its last owner was Tycho Brahe. It was destroyed by fire in 1597.

It appears that Copernicus never intended to take his degree at Cracow. Just why he returned to his home in 1494 does not transpire. A canonry of Frauenburg Cathedral was vacant at this time, and an effort was made to have him appointed, but the

Roman curia named another for the office, and Copernicus entered the University of Bologna as a student of canon law, attending also the lectures of Novara in astronomy.

Here, with his brother Andreas, he was compelled to borrow money on the security of his uncle's name, and at ruinous rates of interest. These loans were honourably secured and as honourably and promptly paid. This loan seems to have been necessary in view of the circumstances; indeed, Copernicus is almost monotonously noble. He deliberately determined that his life should exclude all that was unworthy, and the resolution was rigidly kept.

In 1497, the recently appointed canon of the Frauenburg, conveniently vacated the office, having died that year, and Copernicus was nominated and appointed to succeed him. From this time, while still pursuing his studies in Italy, he gave occasional lectures on mathematics to brilliant Roman audiences. In 1501, he obtained further leave to pursue his studies, and turned to Padua where he entered the medical school and sought diligently to master the healing art.

Thus was Copernicus a mathematician, a doctor of canon law, a doctor of medicine, a secular canon of the church, and incidentally, though most important of all, an astronomer. It is interesting to note how some men find roads to greatness through many avenues of expression. We think of Michelangelo, of Leonardo da Vinci, of Goethe, of Lorenzo de Medici, and wonder if it is not true that the higher the mountain, the wider its base and the greater the number of rivers flowing from their sources in its slopes and canyons.

The medical skill of Copernicus was ever at the command of the poorest in his town. Occasionally he was called to attend the rich, and once, at least, his services were called into requisition at court, where, we are told, the patient recovered. An early and curious law forbade the practice of medicine by ecclesiastics. This canon law was now obsolete as to the medical part of the doctor's duties. It was not permitted, however, that any sacred office should be exercised by one who engaged in the use of the scalpel or the cautery. These practices were adjudged to have the effect of hardening the heart, hence the prohibition.

The astronomical attainments of Copernicus were supposed to fit him peculiarly for the practice of the healing art. The common

belief attributed a more powerful action of certain drugs to special planetary conjunctions. Every zodiacal constellation had its peculiar influence on a certain part of the body. The effects of remedies depended upon the position of the moon in the zodiac.

It is assumed that because Copernicus copied more than once a prescription whose numerous and varied ingredients would remind one of the contents of the witches' cauldron, he therefore probably used it. I doubt the correctness of this inference. I fancy the remarkable prescription was kept as a curio with which to regale his friends, all of whom, no doubt, could appreciate a joke. Moreover, whatever the nature of his prescriptions, the patients of Copernicus had a happy habit of making a good recovery.

It helps if a man or woman is born at the right time. During the youth of Copernicus, whether unnoticed or acclaimed by the thunders of fame, many personal forces were beginning to move the world. Gutenberg (1398-1468) had introduced his movable plates and printing press. The Tudor period had begun in England. The stormy period of the Medici in Florence was for the moment tranquilized under the beneficent tyranny of Lorenzo the Magnificent, that notable patron of art and letters. Michelangelo and Leonardo painted their wonderful frescoes and chiseled the forms of their genius out of stone while Savonarola thundered his eloquent warnings from the pulpit of San Marco. In the midst of it all Martin Luther stood in the Diet of Worms solemnly declaring: "*Hier stehe ich; ich kann nicht anders.*" All the while civilization was under the mighty spell of that outstanding fact, that Columbus had broken through the last barrier of the old world and found a new hemisphere.

Before this great seething cauldron of the new age—the new learning, the new navigation, the new religion—stood Copernicus, as resurgent as any.

We are too ready to regard the ancients as crude without any other reason than the fact that they were ancient. The Hebrew poetry pictured a four-cornered flat earth around which a spherical star-studded sky revolved. Pythagoras, Philolaus, Anaxagoras, Hietatis and others had spoken of the round earth and other spheres, making many prophetic guesses at the truth, and often very nearly hitting the mark. The system described by Ptolemy

in his *Almagest* was very complicated, requiring more than sixty circles to explain it, but it was very cleverly worked out. Based on what was known by astronomers at the time, the Ptolemaic scheme was most ingenious. It had been accepted for nearly fourteen centuries and was hard to supplant.

Some minds are hospitable to complexity. Others demand the simplicity of generalization. The former is often dominated by detail, the latter by law or principle. But complexity is nearly always somewhere involved within the generalization no matter how true the principle may be. To our finite minds, some details seem ever to remain unexplained. Perhaps he is happiest who can with simple faith accept the thought of

> "One law, one faith, one element,
> And one far off divine event
> To which the whole creation moves."

The heliocentric system was not a complete explanation of the heavens. Copernicus failed to divine the elliptical orbit and had still to resort to thirty-four epicycles to explain his view. It remained for Kepler to introduce the discovery of the ellipse before supreme order could be said to reign in our mathematical concept of the skies.

Returning to our story, we find Copernicus, having studied at three universities (Cracow, Bologna, Padua), receiving his degree at a fourth, in the episcopal palace at Ferrara in 1503. After two further years in Italy, at thirty-two years of age, he returned to Ermland and engaged in political life, as the records of certain assemblages show. By resolution of the chapter dated January 7, 1507, he was appointed permanent physician to the bishop, at whose episcopal residence, the castle of Heilsberg, he remained a member of the household till his uncle's death in 1512.

Heilsberg is 46 miles from Frauenburg. From the rather formidable looking castle walls are seen the rivers Alle and Simser, which wind their tortuous courses till lost in extensive forests of oak and beech with which the country is well wooded. Heilsberg Castle in those days was like the stronghold of a mediaeval prince. The open court was thronged with a motley crowd of ecclesiastics, pages, servingmen, jugglers, minstrels, clowns, and other retainers. The times were perilous. The bishop's charge was no sinecure.

Messengers were constantly bringing tidings of some new outrage; grave churchmen with weighty spiritual matters sought their solution; young noblemen with ambitions, and mendicants with their humbler plaints sought help of the good bishop. Every sort of society was represented in this throng.

At noon a great bell tolled the signal for the midday meal. Thereupon, a procession led by the bishop in full choir-costume, attended by vicar, chief justice, chaplain, chamberlain, marshal, guests and retainers in order, led the way through the courtyard, to the great banqueting hall. Eight tables were spread; for, of the eight different degrees of dignity, each had his place fixed by authority. The buffoons and jugglers occupied a conspicuous central position so that all might enjoy their sallies.

For six years, Copernicus was daily a member of this procession and assemblage. As days and months passed, he must have shared more and more, at first as confidante, and later, no doubt, as occasional adviser, the burdens, anxieties and obligations of the government of Ermland with which his uncle, the bishop was charged. The latter was at once prince of the empire and vassal of Poland. He was, *ex officio*, a member of the Polish senate and vice-regent of the Polish king in west Prussia. Poland and Prussia each sought his defence against any encroachments on its rights by the aggressive action of the other.

Ermland was the only one of four Prussian dioceses which preserved its independence. Thus the bishop of Ermland ruled a little state. He was required to conciliate, and yet hold in check, three neighbours, all mutually hostile, some of them powerful and ambitious, all restless, and one of them, at least, discontented. Thus the task of the bishop was almost an impossible one. Besides, Watzelrode was not much of a politician. He had energy and probity, but was strenuous without being supple and resourceful. Though his designs were all admirable and well-meant, they generally failed.

Copernicus and his uncle were seldom apart. They not only dwelt together, they travelled together. When the bishop went abroad to Petrikau, to Thorn, to Cracow, to diets, conferences, or royal solemnities, his nephew was his trusted companion. On the occasion of one of these journeys prolonged for two months,

Copernicus found time to translate from the Greek of Theophylactus Simoncatta, a Byzantine writer, the first work of a Greek author to be printed in Poland. This was published in Cracow. Dr. Leopold Prowe thinks the work betrays more enthusiasm for Greek culture than of proficiency in Greek scholarship. We should not forget that classic Greek was still a language little known, and possibly the only persons in the north who knew more of it than Copernicus were the famous trio of Oxford.*

It was during his residence in the castle of Heilsberg that Copernicus laid the foundations of his new thought of a heliocentric astronomy. While he was in Padua, the theories of Pythagoras had been freely discussed, and his mind had been opened to a keener scrutiny of the accepted teaching of his day. It is difficult for us to realize how interesting the Pythagoreans must have been to those who first questioned the canons of Ptolemy. To these ancients, the planets, the moon, and the spheres all revolved around a central fire from which the sun received its light and reflected it on us. They had learned that the light of the moon was reflected. They supposed that the sciences of music and of numbers were intimately involved in the movements of the heavenly luminaries. They combined their astronomical and their musical systems in the celebrated teaching of "the music of the spheres". The velocities of the moving bodies depended upon their distances from their central fire, the slower and nearer bodies giving out a deeper, and the swifter a higher note. Meanwhile we cannot hear sphere music because we hear it always and are never in a position to contrast it with silence.

While by no means accepting all the Pythagorean doctrines, Copernicus acknowledged that they gave him his first hint of the true hypothesis. He returned from Italy with a mind which could never again accept the geocentric as opposed to the heliocentric system. His own conception as presented in *De Revolutionibus* seems to have been, in the first place, an inspiration from the Greeks rather than the result of observations. These latter, he hardly began to make till 1513, after his return to Frauenburg, and he was never a very accurate observer, accuracy not being necessary for his larger purpose.

*More, Colet and Erasmus.

In March 1512, the bishop was bidden to the wedding-feast of the King of Poland. Copernicus accompanied, but for some unknown reason did not return to Heilsberg with his uncle. The bishop was taken ill on his way home and died three days after his arrival, at the age of 64 years. This was on March 29, 1512. Andreas, the brother of Copernicus, was seized meanwhile with leprosy and died before 1519.

Upon the death of his uncle, Copernicus returned to Frauenburg, and though he never took orders as a priest, he administered the functions of his office, whether sacred or secular, with conscientious diligence and dignity. His stipend was equal to $2,250. This with the income from another source, for he was also commissary of the diocese of Ermland, was sufficient to maintain in easy financial circumstances one with his simple tastes.

Through the dust and clouds of four centuries we see again the cathedral of Frauenburg with its six towers surrounded by walls and bastions rising from a commanding eminence near the town. Externally somewhat frowning, it has a restful interior. A monument has been erected in the cathedral bearing the inscription:

Astronomo celeberrimo, cujus nomen gloria utrumque implevit orbem.

The administrative duties of Copernicus were somewhat harassing. The conflict of the new learning with the old was raging, and its battles, we are told, did not always end without bloodshed, being complicated with political, racial and national animosities such as still disturb the peace of central Europe. Doubtless Copernicus held himself as aloof as possible from these unseemly disorders, but he had a great admiration for classical antiquity which set him fairly with those who furthered the revival of learning. Nevertheless, his mind was independent, being animated, but not enslaved, by its classical enthusiasms.

We may be sure that, amid all his worries, Copernicus was not careless of his dream. His soul was too much exalted in its vision, his spirit too fine in its fibre, to permit his ordinary duties, either temporal or ecclesiastical, to dim to darkness the rays of his life's central luminary. All permanent progress is made, all great achievements are consummated as a result of clear thinking and intense feeling.

A dream is stronger than a battle host;
A thought well turned may beat an empire down.

The voices that most have moved the world have spoken first, out of the silences of heaven, a music that neither ear nor heart could resist. Such voices, if they be real and authentic, compel our judgment and convince our reason, and only the closed mind will sleep, only the prejudiced heart will resist.

The renascent heart, unconvinced by the *ipse dixit* of the misty ages, broods over the possibilities of some new system lying unborn in the womb of nature, whence all new life emerges; feels the quickening movement and hears the whispered promise of new birth to a fuller life, a larger conception, and a richer experience. For life is richer when our heavens grow larger, even though, meanwhile, the earth should dwindle.

Some will say that with the passing of myth, the poetry vanishes from the sky. But may there not be a new and nobler mythus in nature than the ancients ever dreamed. Let us make for ourselves a new expression of more beautiful poetry to celebrate the newly-ascertained fact. Be sure, that age is decadent which is looking to the past for its inspirations. Our age shall be young again in a new renaissance; then its poetry, inspired by new and loftier dreams, shall be sacred as that of David or Isaiah.

Amid those whirlwinds of change that swept across the gulf of time, Copernicus, though alive to the situation, kept his counsel and did his work faithfully and well. He had a residence within the precincts of the Cathedral and a country demesne besides. Two men and three horses were at his service. His associates in the chapter were men of education, taste and culture. One of these, Tiedemann Geise, afterwards became the bishop of Culm, and it was to him that Copernicus entrusted his manuscripts when at last he decided to have them printed.

From a species of terrace adjacent to the "Copernican tower" the eye wandered undisturbed across the blue expanse. In clear weather, one could discern afar, beyond the white dunes, the dark line of the Baltic Sea. The view on the east was interrupted only by the cathedral. It was here that Copernicus set up his "triquetrum", an instrument for taking the altitude of the stars. It consisted of three finely graduated parallel strips of deal, and was constructed by himself.

Copernicus was at once bailiff, military governor, judge, tax-collector, and vicar-general. Besides these stated duties, various commissions, and the practice of medicine on necessary occasions, he prepared for King Sigismund in 1532 a treatise on the currency.

The Polish kingdom at this time included Thorn, Dantzic and a large part of Prussia. But a portion of Prussia, including Königsburg, had been erected by the Treaty of Cracow, concluded in 1525 between the king of Poland and Albert, Margraf of Brandenburg, into an hereditary fief for the benefit of the latter and his male descendants. As by this arrangement Margraf Albert held his feudal tenure subject to Sigismund King of Poland, the two countries were in a sense one. Copernicus set forth to his king what measures were necessary in order to restore stability to the much depreciated Prussian money, and maintain the value of the new coinage on a parity, so that it could circulate both in Poland and in Prussia.

After pointing out how useless it was to attempt to introduce into circulation, by the side of a depreciated currency, one of greater value, he explained how the introduction of a cheaper measure of value by the side of the higher one would drive the coin of greater value out of circulation.

> "If it does not do to introduce a new and good money while the old is bad and continues to circulate, a much greater error is committed by introducing along side of an old currency a new currency of less value. This latter does not merely depreciate the old, it drives it away, so to speak, by main force."

Copernicus further observed that if the two countries were to be drawn together, and neither was to suffer the results which follow in the wake of a debased coinage, it was necessary for both to issue money of a similar degree of fineness. That fineness, he said, should be the full intrinsic value of the pure metal "with only so much alloy as may be necessary for the difference between the real value and the nominal value, to cover the cost of minting, which will avoid the principal attraction to remelt it".

He insisted that the value-ratio between gold and silver in the coinage should be precisely that of the gold bar to the silver bar. The whole contention of Copernicus reads wonderfully like a recent political speech such as a Republican orator might have delivered in a campaign in which a well-known candidate for the

Presidency of the United States sought to readjust the ratio between gold and silver coinage in that country, using as a slogan, "They shall not crucify humanity upon a cross of gold". One may go back farther than Copernicus to find the currency problem. Aristophanes says in his "Frogs":

> "Oftentimes have we reflected on a similar abuse
> In the choice of men for office and of coins for common use."
> (*Frere's translation.*)

This paper on the coinage was presented at the Diet of Graudenz. A single mint was to be established and a coinage of high standard was to be issued. The proposal was futile because it provided for the general welfare of two countries, whereas the members of the Diet cared only for their own personal interests. The question came up from year to year, and Copernicus pressed its importance upon the attention of the Diet, but the much needed reform did not prevail.

The Lutheran "reformation" was now becoming a powerful force in Prussia, and Martin Luther advised Margraf Albert to marry and exchange the spiritual dignity of grand master for the temporal one of duke of Prussia. The position of Copernicus became more and more difficult. Friends passed away. A new generation arose. A great revolution in life and thought shook all Germany. The doctrines of Luther had been received with only mild dissent, if not with distinct approval, throughout Ermland. Those who remained true to Rome hoped that by charity and patience the wanderers might be won back into a united church. Of these latter was Copernicus. He appealed to that sweet reasonableness which lurked, as he suspected, in the souls of all thoughtful men.

The masses were swept into the great gulf of change, and passion acted in many cases before reason had time to speak. One of the Frauenburg chapter was accused of disloyalty, and Copernicus, of undue intimacy with the erring one. He submitted to the request that he would avoid such intimacy in the future, but with reluctance. The erring one was tried in Rome and acquitted, but the incident caused Copernicus much pain.

Beyond this incident, the eminent astronomer never had reason to feel that the church had been unfair. One of the bishops of

Ermland had been very ungenerous, and, as far as he could, had made the life of Copernicus miserable for years, but this was merely a personal matter which the church as an institution never countenanced.

It remains only to tell the story of that important work which laid the foundations of astronomical science for all time, and gave to its author the most prominent place in its annals.

As already stated, the foundation of *De Revolutionibus* was laid at the castle of Heilsberg. This was in 1507-1509. When he went to Frauenburg, he began to make his more careful observations, the book was enlarged from time to time, and the last record was added in 1529, though it was not published till 1543. His work was interrupted by many duties. Twice he was obliged to reside at the castle of Allenstein while he administered the affairs of that district. These two visits covered about six years. For seven months he was acting as bishop of Ermland during an interregnum. He was appointed more than once to represent the interests of the chapter in their grievances against the king of Poland and the Teutonic knights. Still his occupations left him much time to pursue his astronomical work. He seems to have intended to disseminate the truth he had formulated as the Pythagoreans were wont to do, only by oral tradition. He had little care to be prominent himself and seemed to be utterly devoid of self-interest.

About 1530, a brief manuscript commentary was prepared by Copernicus for private circulation. Two copies of this MSS. are still extant, one in Vienna, the other at Upsala. It closes with a *resumé* of his doctrines arranged in seven propositions. These are:

1. There is only one center to the motions of the heavenly bodies.
2. This is not the earth about which the moon moves, but
3. It is the sun.
4. The sphere of the fixed stars is indefinitely more distant than the planets.
5. The diurnal motion of the sun is a consequence of the earth's rotation.
6. The annual motion of the sun, and
7. The motions of the planets are primarily not due to their proper motion.

No secret was made of the new teaching, and Copernicus was not afraid of the church of which he was a faithful son. It is true as already stated that one of the bishops of Ermland was not friendly, but this was due to the knowledge that Copernicus,

though he voted for his unfriendly rival, would have preferred another in that office.

It must not be supposed that Copernicus neglected the duties of his cathedral or of the church to devote his time to astronomy. As "'visitator", as "nuncius capituli", as medical adviser to a trusted councillor of the Duke, who, by the way, was a heretic, he spent what time was necessary in these common or special duties, using only his leisure for more scientific pursuits.

From time to time, Copernicus was urged by his friends to publish his book. He had little fear of opposition so far as he himself was concerned, but he knew that the Lutherans were strongly opposed to it. Many scientists were also opposed, and he was much averse to stirring any controversy which might widen the breach between the two sections of a church already rent with disunion.

The friendship of George Joachim (or as he preferred to name himself, Rheticus), (1514-1576), provides a most inspiring story in the life of Copernicus. The incident opens in 1539, when the great astronomer was 66 years of age and Rheticus but 25. Years make some people think they are old. This is a great pity. Some of the most intimate and beautiful attachments subsist between persons of widely diverse ages. The friendship of Paul and Timothy was not more ideal than that of these two eminent mathematicians.

There is some doubt as to whether Copernicus would ever have consented to publish his work in full if Rheticus had not brought his eloquent appreciation to bear upon the master. It is true that Copernicus had made no secret of his views. Brief statements in script had been circulated privately, yet, although Cardinal Schönberg had formally demanded its publication, Copernicus still hesitated. His old friend Geise, now Bishop of Culm, had also used his persuasion, but it remained finally for his dear young friend Rheticus to prevail upon him to publish the complete work.

When Rheticus returned to Wittenburg after a visit which, though intended to be brief, had been prolonged for two years by the compelling influence of their growing friendship, he took with him the purely mathematical section of the work of Copernicus, and this was printed in 1541 under the title, "Trigonometry." It is almost certain that the master had given his young admirer reasonable assurance that the whole work would soon appear.

Accordingly, the book was sent to his old friend, the Bishop of Culm, with permission, if he wished, to have the work printed. The bishop sent it at once to Rheticus, who made arrangements to have it published in Nürnberg. No doubt this young scholar would gladly have seen the book through the press himself, but he had already been away from his chair in mathematics at Wittenberg for two years, and imagination can easily supply reasons why he should return to his university and—to his income.

Printing was still a new art. Nürnberg was hundreds of miles from Frauenburg, and even beyond Wittenberg nearly 200 miles. It was necessary to have some one look after it. Osiander of Nürnberg, a Lutheran scholar, astronomer, and minister, was interested, and he superintended the work. But unfortunately, the man had not the great soul that such a task demanded. A prefatory note, composed by Osiander, but unsigned, was inserted, setting forth that the work was merely the exposition of a theory and not in any sense intended as being final. This note went out as the word of Copernicus himself, and was removed only after centuries, and with much difficulty, by those who knew its falsity.

Osiander's note may have been inspired by the opposition of Luther and his followers. Luther himself characterized Copernicus as "a fool for holding such opinions . . . contrary to Scripture". Nevertheless Osiander's act was dishonest, and wholly misrepresented Copernicus' attitude. It remained in its false relation for over 300 years.

The offending note was as follows:

"Scholars will be surprised by the novelty of the hypothesis proposed in this book, which supposes the earth to be in motion about the sun, itself fixed. But if they will look closer, they will see that the author is in no wise to be blamed. The aim of astronomy is to observe the heavenly bodies and to discover the laws of their motions. The veritable causes of their motions, it is impossible to assign. It is consequently permissible to imagine causes, arbitrarily, under the sole condition that they should represent, geometrically, the state of the heavens, and it is not necessary that such hypotheses should be true or even probable. It is sufficient that they should furnish positions that agree with observations. If astronomy admits principles, it is not for the purpose of affirming truth, but to give a certain basis for calculation."

Besides the commitment of this falsity, Osiander added the last two words to the title of the book and made many changes in

the text. There is some doubt as to whether the Congregation of the Index would have passed their famous decree of March 5, 1616, but for the discredit thrown on the Copernican system by Osiander's note.

In dedicating his book to Pope Paul III, Copernicus, no doubt, realized that he was helping the whole church to get a highly reasonable view of his work. This dedication is somewhat in the guise of an apologia. And yet one of its first sentences must have struck the reader as being strangely out of tune with the false note inserted by Osiander: "I am so much in love with my conclusions as not to weigh what others will think about them." He proceeds further: "The book had lain in my study, not nine years merely, but already going on four times nine." Then comes the spirit of the apologia: "I knew that the liberty had been granted to others before me to postulate all sorts of little circles for explaining the phenomena of the stars. I thought I also might easily be permitted to try whether, by postulating some motion of the earth, more reliable conclusions could be reached regarding the revolutions of the heavenly bodies than those of my predecessors".

He now proceeds to tell of the plan of the work:

> "In the course of the book, I have followed this plan: I describe in the first book all the positions of the orbits together with the movements which I ascribe to the earth, in order that this book might contain, as it were, the general scheme of the universe," etc.

There are six books in the treatise, containing in all 130 chapters. The author shows that day and night are produced by the rotation of the earth and not by the revolution of the sun; that the seasons are the result of the inclination of the axis of the revolving earth as it passes through its orbit around the sun. He showed also the cause of the precession of the equinoxes in the varying inclination of the earth's axis.

The evidence of the earth's rotation as cited by Copernicus was very meagre. The evidence that the earth moves around the sun is found in the simplification of the phenomena by such an hypothesis. The stationary positions and backward loopings of the planets, which as actual facts seemed so fantastic, were shown to have no real existence. These were only apparent and depended

upon the relative positions of the earth, the planets in question, and the stars.

Copernicus had still 34 circles in his system, yet he exclaims:

"Thus 34 circles suffice to make plain the entire structure of the world, the entire mazy round of the starry dance."—*Prowe Th.* ii. p. 292.

Forcaster employed 63 circles to explain the Ptolemaic system. But if Copernicus were right, then Mercury and Venus must have phases like our moon. "Have patience, time will tell", was the answer. Kepler (1571-1630) supplied the ellipse, Galileo (1564-1642), the telescope, and Newton (1642-1717) the law. Copernicus, Kepler, Galileo, Newton—these four, and lo, the new Astronomy.

It seems to be a law that the more sublime an idea is, the more opposition and ridicule it meets with. The doctrine of the earth's motion was made the subject of a farce and was put on the stage at Elbing during the carnival in 1531. Such frivolries still take place, little men still win immortality by opposing or misrepresenting great ones, and Elbing and Osiander have their counterparts in our own times.

That the Roman church placed Copernicus' book on the Index is not strange. The members of the Congregation of the Index saw Ptolemy opposed by Copernicus, Copernicus by Tycho Brahe, Tycho by Kepler, and all within their own memories. They were wrong only in their condemnation of a matter they in no wise understood. But in this too, history repeats itself. At Wittenberg, Rheticus and Reinhold were compelled to teach the Ptolemaic system just as Galileo, at Padua, had to confine his teaching to the exposition of Sacrobosco.

It is interesting to note that Francis Bacon rejected the Copernican theory, while Milton accepted it. Tycho rejected, but Kepler accepted. Luther, Melancthon and Calvin rejected it with scorn. Pascal says: "*La silence èternel de ces èspaces infinis me affraie*".

A destructive fate seems from the first to have attended the memoirs of Copernicus. We are reminded of the case of Horrox, many of whose writings and memoirs suffered a similar fate. Rheticus wrote a biography of Copernicus under his very eyes. It was therefore accurate. But it perished at birth, and was never printed. Other accounts of this life were written, but none were adequate till Dr. Leopold Prowe, after thirty years of careful

research, published his *Nicolaus Copernicus* in 1883. A centenary edition of *De Revolutionibus Orbium Cœlestium* was issued at Thorn in 1873. This appears to have been the first copy printed without the Osiander note. A copy of this edition is to be found in the library of Toronto University. An excellent editorial in the *Edinburgh Review* is to be found in Volume 158 of that periodical. It is based on Prowe's researches. Another valuable article, by E. S. Holden, LL.D., is printed in *Popular Science Monthly* for June 1904.

Outside of Prowe's work, there seems to be a dearth of information about the great astronomer. T. Willing Balch has published a book entitled *The Law of Oresme, Copernicus and Gresham*, which contains the work of Copernicus on the currency set forth in English, together with the teaching of the others named in the title. Another work of interest is *Prefaces and Prologues to Great Books*, published by Colliers in 1910. It contains an English translation of the dedication of *De Revolutionibus*.

A drama entitled *Copernicus* was written by Adolf Prowe and presented in the National Theatre at Thorn in 1873, to commemorate the four hundredth anniversary of Copernicus' birth. The text is in German. The last act closes with Tiedemann Geise, Cardinal Culm and other friends at Copernicus' home, where the great astronomer is dying. Rheticus arrives with a copy of the new book in print. Copernicus takes it in his hands and says brokenly:

> "Ich fuhl's—O Seligkeit—O Himmels—Wonne—
> Der Erdball fliegt—mit mir—zur Geister—Sonne."

Four centuries have passed and the dust of Copernicus lies in its narrow crypt in the old cathedral. The Vistula still rolls to the Baltic. The mediaeval Renaissance is almost forgotten, but a vaster world is tossed in the furious whirlwind of a more appalling revolution. Civilization is once again melted in a crucible of fire. As no man in 1519 could measure the renaissance of that day, so no one can tell the final bounds of that mightier revolution and that diviner result which must follow the present universal storm. The evils of materialism, its grossness and cruelty, have had their blighting expression in our times, so the Divine Spirit, expressing itself, as it has done so extensively in deeds of love-sacrifice far beyond our praise, will prove itself to be the shield and stay of

our race, and show, as never before, that the Cross of love, which is the Cross of Christ, is the only source of perpetual rebirth for humanity.

The following monologue, though written some time ago, finds its fitting place at the close of this article. It is spoken by Copernicus to Cardinal Schönberg.

Copernicus speaks:

Why not imprint the book?
That have I now at last resolved to do;
But know'st thou not, good bishop, how that he
Who serveth least doth make the greatest haste,
And, having once discerned some shred of truth,
Is exercised thereby immediately
To reach the housetop and inform the world?
The highest themes engender large repose
That hastes not till the callow thought matures
Beneath the warm protecting wing of time,
But when the hour of destiny has come,
Descending like an avalanche of stars,
They sweep down far immeasurable years
Where ages are but moments.

Truth needs not
That any soul be else than simply true;
Therefore I hasted not when law I learned,
But found not equity; and medic lore,
But saw results were late or dubious.
My proper science is theology,
Since I am canon in the Frauenberg,
But here, outside the art of kindliness,
Truth-labels on opinions pasted firm
Make up our creed. The priests of science too
Stamp dogma with the seal of truth, and both
The church and school have still their means to curb
Truth inconvenient.

Of all the arts
My thought had tried, none seemed to me so sure
As mathematics when she stately walked
The pathway of the stars. The spheral ways
Are large. Disposed to such high themes,
My soul grew reverent 'neath a vaster sky.
The forces of the universal deep
Fell on my heart like music while I watched
The bright procession moving down the night.

My mind escaped the fetters of old forms,
Was turned to more majestic harmonies.
My free imagination toured the sky
And mapped the planets' courses, till at last
I found myself on one of them, elate,
Circling the sun.

I see the earth no more
A centre of the planetary ways,
The fixèd hub of solar orbit wheel,
But moving silent in its cosmic path,
A little sister of great Jupiter.
And since my life has reached threescore and ten,
And six-and-thirty years have passed since first
I saw the earth a little wanderer
Among the greater worlds, I am resolved
To send the manuscript to Nuremburg
To be imprinted there. My failing powers
Make instant furtherance of such design
Imperative, if I would see the book
Before I die.

The mighty hemisphere
Columbus sought and found is better known
To even the very least geographer
Than ever 'twas to him who found it first.
So shall the key that I shall give to man
Unlock the golden gateway of the skies.
My thought shall be his pilot through the deep,
So in the coming days a child shall know
The seas of light that flow above the world,
The blue, mysterious, oceanic heavens,
More intimately than the Polish priest
Who first discerned how mightily the sun
Leads all his orbs, and blazes out their way
Through the stupendous deep.

MEETINGS OF THE SOCIETY

At Toronto.

May 6.—The Society met at 8 p.m. in the Physics Building of the University of Toronto, the President, Mr. A. F. Miller, in the chair.

The President spoke of the good attendance at the Observatory on two nights recently when the telescope was available, and of the interest manifested by those who attended. He concluded that if the Society had an Observatory of its own, as it is proposed to erect, there would be good attendance and an increased interest in astronomy.

The monthly report of the Librarian showed that the Society had received 48 publications in April.

Mr. J. P. Henderson referred to the present very large group of sunspots, which may easily be seen with any ordinary telescope, and showed a diagram as they appeared on May 6.

Several members had observed auroras recently, some being important displays. One outbreak about 1 a.m. on May 3, mentioned by Mr. Jackson, accompanied a magnetic storm which lasted all day of the 3rd.

Mr. W. E. W. Jackson showed a copy of a seismograph record of an earthquake on May 2, the distance of which from Toronto had been estimated by Dr. Klotz to be 4760 kilometres. It occurred in the north part of South America.

Mr. A. F. Miller spoke of the sharp secondary deflections in the tracing of the barometer record, and Mr. Jackson pointed out that such deflections often occurred during a thunderstorm, which was the case in the examples mentioned by Mr. Miller observed on May 4.

A letter from Mr. David A. Keys described an aurora at Shandon, in Dumbarton, Scotland, on March 27.

Dr. A. D. Watson read the paper for the evening on "Copernicus". The new age of discoveries in which Copernicus lived had been introduced by Columbus, and it included other great names as Gutenberg, Luther, Savonarola.

The astronomy of the time was the geocentric system of Ptolemy, expounded in the second century in the *Almagest* and postulating some sixty spheres for celestial movements. Copernicus propounded a new theory of celestial bodies, viz., the heliocentric system, in which the sun is assumed to be the centre, and this view has been adopted. The astronomer studied a wide range of subjects while with his uncle at Frauenburg, as medicine and the depreciation of currency and some lantern pictures shown by Dr. Watson gave an interesting view of Frauenburg Cathedral and extant portraits of Copernicus. The book in which Copernicus put forward his system, viz., *De Revolutionibus*, was published by Rheticus at Nuremburg. Copernicus assumed 34 circles in his system, because he did not know of the elliptic movements of the planets, which Kepler afterward showed. Dr. Watson's paper was exhaustive, and showed a large amount of research in the biography of the distinguished astronomer.

May 20.—The Society met at 8 p.m., in the Physics Building of the University of Toronto, the President, Mr. A. F. Miller, in the chair.

William S. Bethel of Los Angeles, Cal., was elected a member of the Society.

The approaching total eclipse of the sun on May 29, although not visible in Canada, was discussed on account of the importance of the event in astronomical research.

Mr. A. F. Miller stated that on June 8, 1918, the date of the last total solar eclipse, he had made spectroscopic observations on the prominences of the sun just before the beginning of the eclipse, and afterward found that the spectroscopic record showed the prominences to be smaller than observers had actually found them to be when observed during the eclipse; and he inferred that some allowance would have to be made in future for the incompleteness of the instrumental records. He had found the active group of sunspots now showing on the sun's disk to be visible to the naked eye. He also described his observations of May 14 on certain

appearances of Saturn's rings, using a power of 400, the atmosphere having been unusually clear on that date, after the prolonged heavy rains.

J. A. Paterson, M.A., K.C., gave the address of the evening on the noted astronomer, Sir David Gill, who belonged to the group of great British scientists with Lord Kelvin and James Clerk Maxwell.

Sir David Gill was born in Aberdeenshire, Scotland, in 1843, and died in 1914. He had been at first engaged as watchmaker, the same trade which his ancestors for two generations had followed, but gave up this occupation for the pursuit of astronomy. In the education of the young astronomer, Prof. David Thompson of Aberdeen exercised a strong influence over him. Making use of his knowledge of watchmaking, he constructed a 12-inch reflecting telescope with a focal length of 10 ft., and with it began the study of the stars. In 1872 he became director of the Dunecht Observatory, and remained in this position for four years, after which he made an astronomical expedition to the Mauritius. He had charge of astronomical work at Capetown, South Africa, 1885-96, and devoted much time to solar and stellar parallax, using the heliometer with the highest degree of accuracy. He also initiated the method of photographing the entire sky. Amongst his friends of many years standing were James Clerk Maxwell, Simon Newcomb and Kapteyn. Mr. Paterson's address summarized Sir David Gill's life and work with minuteness and in an interesting manner.

A. F. HUNTER,
Recorder.

NOTES FROM THE METEOROLOGICAL SERVICE

Summary Report of the Weather in Canada

April, 1919.

Temperature—The mean temperature was above normal in all districts west of Lake Superior, and below in all districts east. The largest positive departures, about 6°, occurred in Alberta and Western Saskatchewan, and the largest negative, from 3° to 4°, in the Ottawa Valley. In the Western Provinces there were no really cold spells, but from Ontario eastward the month opened quite cold, and on the 24th and 25th an unusually severe dip occurred in Ontario and Quebec.

Precipitation—In British Columbia the total precipitation was very generally in excess of the average. In the Western Provinces it aggregated an amount somewhat in excess of the average in the more southern districts, while in the north it was deficient. In all other parts of Canada, except in Ontario between Lake Superior and the Manitoba boundary, it was in excess, and particularly so in southwestern and eastern Ontario and throughout the Province of Quebec. The heaviest snowfalls occurred in both Ontario and Quebec about the 25th and 26th.

May, 1919.

Temperature—The mean temperature for May was above the normal over the entire Western Provinces and in the Lake Superior District, and slightly below over the greater portion of British Columbia. Positive departures amounted to about 6° in some sections of Saskatchewan and Manitoba. From the Lower Lake Region eastward to the Maritime Provinces the departures from normal were very small, being below in the more central parts of Ontario and northern Quebec, elsewhere above.

Precipitation—The most marked features of the precipitation were the lightness of the rainfall in Saskatchewan, and the excess in southern and eastern Ontario and the Maritime provinces; elsewhere departures from the normal amount were comparatively small.

TEMPERATURE FOR APRIL AND MAY, 1918.

STATION	April		May		STATION	April		May	
	Highest	Lowest	Highest	Lowest		Highest	Lowest	Highest	Lowest
Yukon					Huntsville	67	−2	89	26
Dawson	53	4			Kenora	68	12	91	25
British Columbia					Kinmount	66	4		
Atlin	47	19			Kingston	69	8	85	36
Agassiz	76	36			Kitchener	65	10	91	34
Barkerville	59	15	64	15	London	70	13	70	12
Kamloops	78	24	83	32	Lucknow	68	9	89	28
New Westminster	70	32	74	33	Markdale	69	7	87	31
Prince Rupert	58	32	58	33	North Gower	69	0	80	28
Vancouver	63	32	68	35	Oshawa	48	14	70	30
Victoria	67	37	69	40	Ottawa	69	4	86	32
Western Provinces					Paris	68	12	93	33
Battleford	77	17	93	25	Parry Sound	68	1	86	30
Calgary	79	21	88	20	Peterborough	66	4		
Edmonton	72	22	88	19	Port Arthur	68	4	76	26
Medicine Hat	80	25	96	27	Port Burwell	65	14	87	32
Minnedosa	69	12	90	20	Port Dover	66	10	86	32
Moosejaw	80	21	93	25	Port Stanley	62	14	85	31
Oakbank	69	13	91	21	Queensborough	65	15	89	33
Portage la Prairie	69	10	93	20	Ronville	66	11	88	32
Prince Albert	74	12	94	20	Southampton	66	12	84	32
Qu'Appelle	73	16	91	22	Stonecliffe	77	−4	92	4
Regina	78	18	95	20	Stoney Creek	64	14	91	35
Saskatoon	75	17	97	19	Toronto	63	10	92	39
Souris	71	14	94	20	Uxbridge	65	11	88	30
Swift Current	74	34	95	20	Wallaceburg	66	20	90	36
Winnipeg	70	13	94	18	Welland	74	12	83	37
Ontario					White River	66	−7	93	2
Agincourt	64	14	88	35	*Quebec*				
Aurora	64	5			Brome	68	4	76	25
Bancroft	78	8	86	26	Father Point	52	14	64	28

TEMPERATURE FOR APRIL AND MAY, 1918—*Contd.*

STATION	April		May		STATION	April		May	
	Highest	Lowest	Highest	Lowest		Highest	Lowest	Highest	Lowest
Barrie	64	4	87	33	Montreal	66	12	82	34
Beatrice	66	0	88	28	Quebec	56	12	78	29
Bloomfield	66	8			Sherbrooke	67	5		
Brantford	68	14	93	37	*Maritime Provinces*				
Chapleau	65	15	95	30	Charlottetown	54	22	72	28
Chatham	74	19	97	36	Chatham	62	14	78	28
Clinton	66	12	84	31	Dalhousie				
Collingwood	67	17	95	28	Fredericton	65	19	78	26
Cottam	69	20			Halifax	56	24	76	28
Georgetown	62	7	87	32	Moncton	62	22		
Goderich					St. John	52	20	74	35
Gravenhurst	68	2	90	30	Sussex	58	20	74	24
Grimsby	60	12	99	35	Sydney	58	22	74	28
Guelph	64	10	89	35	Yarmouth	61	26	70	31
Haliburton	70	0	94	28					

MAGNETIC DISTURBANCES.

APRIL-MAY, 1919.

The principal magnetic disturbances recorded during April and May at Agincourt and Meanook Observatories are given in the following table:

(Ag. = Agincourt, Me. = Meanook).

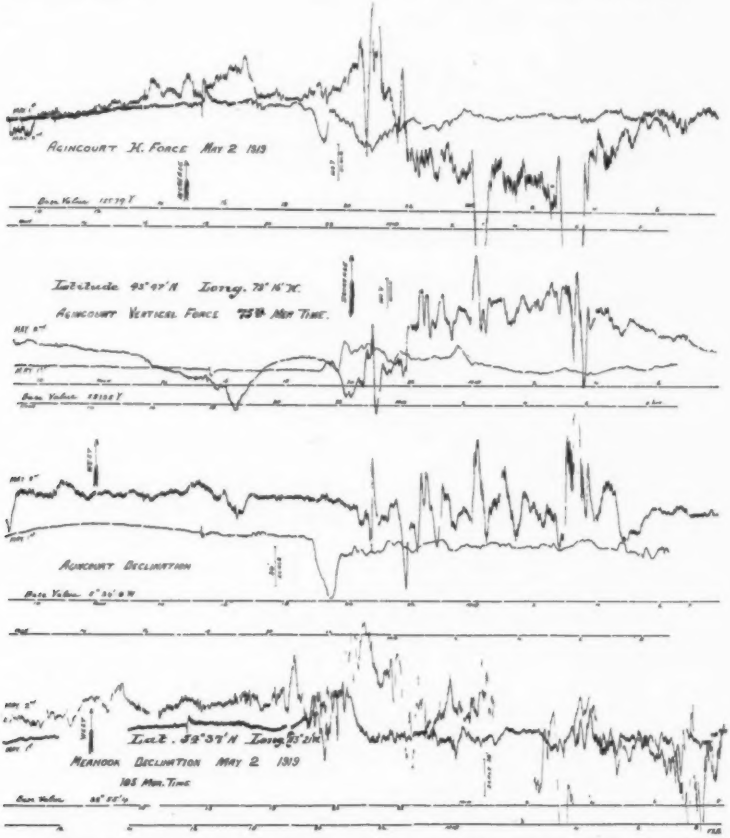
75th Meridian Time					Range			
Beginning		Ending		Ag. D	Ag. H	Ag. Z	Me. D	
	d	h	d	h	° ′	γ	γ	° ′
April	6	15	7	6	1 5.8	412	204	3 17.8
	7	14	8	8	0 48.5	197	208	2 36.5
	16	2	18	19	0 51.6	365	381	3 12.7
May	1	18	4	3	2 21.9	780	540	3 09.4
	4	11	7	6	0 32.8	204	165	1 20.6
	12	17	15	6	0 37.0	261	282	1 31.4
	17	9	18	8	0 43.0	203	224	2 12.7
	20	15	22	5	1 04.7	245	230	1 10.2
	23	22	27	10	1 06.2	303	225	2 38.7

The largest of these disturbances occurred on May 1 to 4 and is reproduced on the accompanying chart. It is of the sudden commencement type.

Very few meteorological observers report having seen the aurora during April and May, although it was seen from some part of the Dominion nearly every night.

Sunspots were numerous but small during both months. One very large group appeared near the eastern limb on the 4th of May, but almost disappeared before the sun's rotation carried it to the western limb.

W. E. W. J.



Photographic Record of Magnetic Disturbance, May 2, 1919, obtained at Agincourt, Ont., and Meanook, Alta.

EARTHQUAKE RECORDS BY MILNE SEISMOGRAPH. TORONTO.

SIR FREDERIC STUPART, DIRECTOR.

P.T. = Preliminary Tremors. S. = Secondary Waves. L. = Large Waves. A. C. = Air Currents. Time is Greenwich Mean Civil Time; it is to be given in hours, minutes and decimals of minutes; 0 or 24 h = midnight.

No.	Date 1919	P.T. Comm.	S. Comm.	L.W. Comm.	Max.	End	Max. Amp.	Remarks
		h m	h m	h m	h m	h m	mm.	
1972	April 15			23 41.6	23 43.5	0 02.6	0.2	Doubtful as to being seismic.
1973	" 16			4 09.8		4 34.2	0.1	
1974	" 17	11?40.7	11 52.1	12 30.3	12 32.2		1.0	10,600 km. Dual. F. merged into next quake.
1975	" 17			13 36.9 13 42.4	13 43.5	14 27.8	0.8	P. and S. merged into previous quake.
1976	" 17	21 00.0	21 05.6	21 07.7 21 11.7	21 19.4	23 16.6	8.5	3810, km. P. not well defined. S. large amp.
1977	" 18		21 15.8	21 20.8	21 21.5	22 01.7	0.8	
1978	" 19			3?12.7 3 38.3				Barely noticeable.
1979	" 21			11 43.7	12 01.1	12 44.5	0.3	
	21	Light off when other station records quake.						
1980	" 22			3 24.7 3 53.4			0.1	
1981	" 23			8 05.6		8 29.1	0.05	
1982	" 27			1 33.9	1 41.6	2 25.3	0.1	Gradual thickening
1983	" 28		7?00 00	7 04.1	7 04.5	7 42.3	0.8	San Salvador. P. not recorded.
1984	" 30	7 32.0	7 40.3	7 44.6 7 48.0	8 19.0	12 39.7	Over 25	6,790 km. One of the largest disturbances we have recorded.
1985	" 30			17 49.0 17 50.3	17 51.5	18 23.8	0.7	

No.	Date 1919	P.T. Comm.	S. Comm.	L.W. Comm.	Max.	End	Max. Amp.	Remarks
1986	May 1			6 09.0	6 15.9	6 50?3	0.8	Gradual thickening
1987	" 2			2 54.7				
				3 02.7	3 08.7	4 36.9	2.2	
1988	" 3	1 05.3	1 15.9	1 22.0				9,520 km. Phases clearly marked.
				1 30.0	1 48.8	3 46.7	6.8	
1989	" 4			23 41.4	23 44.5	23 54.2	0.2	
1990	" 6			5 05.3	5 10.9	6 01?0	0.3	
1991	" 6	20 01.4	20 12.0	20 20.1	21 02.9	0 47.6	8.5	9,520 km. Marked dist. Increase of movement to 21h 56.0m. amp. 3.5.
1992	" 7			5 44.2		5 48.3	0.1	
1993	" 7	5 59.6	6?10.5	6 23.0	6 31.0	7 46.1	1.4	Repeat 7h 25.9m.
1994	" 7			10 28.3	10 33.4		0.05	
1995	" 8			10 50.5			0.05	
1996	" 8			110 3.0	11 08.7		0.4	Gradual thickening
1997	" 8				21 11.2		0.05	
1998	" 14			4 49.3		4 55.6	0.05	
1999	" 18			12 44.0	12 44.4	13 08.5	0.4	Possibly off W. coast of Vancouver Island.
2000	" 19			5 01?6			0.05	
2001	" 20			4 38.7	4 42.1	4 48.5	0.2	
2002	" 22			12 11.3				
				12 24.6	12 35.4	13 14.2	0.8	
2003	" 23			7 08.6	7 12.0	7 29.6	0.2	Thickening.
2004	" 27			17 51.5				
				18 03.7	18 08.5	18 18.6	0.1	
2005	" 29			6 29.1	6 30.1	6 37.1	0.2	Gradual thickening

Period of Boom 18 seconds. Pillar inclination 1 mm. = 0″.45.

EARTHQUAKE RECORDS BY MILNE SEISMOGRAPH.

VICTORIA, B.C.

F. NAPIER DENISON, SUPERINTENDENT.

P.T. = Preliminary Tremors. S. = Secondary Waves. L. = Large Waves. A. C. = Air Currents. Time is Greenwich Mean Civil Time; it is to be given in hours, minutes and decimals of minutes; 0 or 24 h = midnight.

No.	Date 1919	P.T. Comm.	S. Comm.	L.W. Comm.	Max.	End	Max. Amp.	Remarks
		h m s	h m s	h m s	h m s	h m s	mm	
1971	April 16	4 28 55		4 37 21	4 40 49	4 50 14	0.1	
1972	" 17	11 35 36	11 44 31	12 00 53	12 15 16		1.2	7,500 km. Japan? F. merged into next quake.
1973	" 17				13 58 12	14 30 03	0.4	
1974	" 17	21 00 56	21 07 12	21 11 20	21 24 39	23 11 45	9.5	4,530 km. So. Mexico.
				21 16 16				
1975	" 18	21 10 26	21 13 23	21 19 17	21 23 42		1.5	Prob. Alaska. 1,710 km.
1976	" 19			3 18 47	3 21 15	3 27 38	0.2	
1977	" 21			12 03 01	12 13 26	12 55 05	0.3	
1978	" 22			3 24 42	3 33 33	34 07 00	0.2	
1979	" 23	7?47 35		7 58 31	8 05 38	8 20 52	0.2	
1980	" 27			1 13 48	1 18 43	1 35 55	0.2	
1981	" 28			7 10 29	7 17 26	7 42 43	0.6	
1982	" 30	7 29 14	7 36 37	7 48 54	8 03 11	13 28 15	34.5	5,750 km.
	30	Light off from 16 43 45 to 17 45 33, when quake missed.						

As early as possible after June 30 and December 31 of each year the Recorder is requested to fill up the sheets and post the same to the Secretary of the Earthquake Committee, British Association, Burlington House, London, England.

These should be accompanied by copies of important seismograms. Remarks exceeding six words should be entered on separate sheets.

At the end of each Register the equivalent of 1 mm. of amplitude should be stated in seconds of arc.

EARTHQUAKE RECORDS BY MILNE SEISMOGRAPH.
VICTORIA, B.C.

F. NAPIER DENISON, SUPERINTENDENT.

P.T. = Preliminary Tremors. S. = Secondary Waves. L. = Large Waves. A. C. = Air Currents. Time is Greenwich Mean Civil Time; it is to be given in hours, minutes and decimals of minutes; 0 or 24 h = midnight.

No.	Date 1919	P.T. Comm.	S. Comm.	L.W. Comm.	Max.	End	Max. Amp.	Remarks
		h m s	h m s	h m s	h m s	h m s	mm	
1983	May 1			6 25 53	6 30 18	7?13 35	0.1	
1984	" 1			16 10 42	16 16 36		0.1	
1985	" 1			22 09 14	22 14 38	22 24 28	0.2	
1986	" 2	2 29 37		2 41 33	2 50 28	5 01 52	2.4	
1987	" 2				7 06 18		0.05	
1988	" 3	1 01 55	1 10 51	1 24 44	1 30 02	4 11 51	3.5	7,530 km.
1989	" 4			23?14 58	23 28 15	23 49 23	0.1	
1990	" 6			4?49 26	4 54 21	5 06 10	0.3	
1991	" 6	19 56 51	20 05 13	20 18 59	20 37 40	1 04 44	21.0	6,860 km.
1992	" 7	5 37 43	5 43 08	5 52 58	6 02 49	7 52 28	1.0	4,690 km. Repeat 7 : 40 : 51.
1993	" 7				10 07 15		0.2	Very gradual beginning.
1994	" 8			10 47 38	10 52 33	11 00 26	0.5	
1995	" 8				21 06 53	21 13 46	0.2	
1996	" 14				4 35 06		0.1	
1997	" 18	10 28 47		10 29 17	10 30 16	10 39 07	1.0	270 km. Prob. off W. coast of Vancouver Island.
1998	" 19			4 32 49	4 41 40	4 52 29	0.5	
1999	" 19			23 38 45			0.2	
2000	" 20	4 21 35		4 22 34	4 23 33	4 39 46	1.5	550 km.
2001	" 22			12 04 54	12 07 21	13 05 23	0.3	
2002	" 23	7 06 23			7 17 42	7 29 00	0.25	

No further record, due to paper becoming exhausted, until 30th.
Period of boom 18 seconds. Pillar inclination 1 mm. = 0".54.

VERTICAL SEISMOGRAPH.
VICTORIA, B.C.

Date 1919	P.T. Comm.	S. Comm.	L.W. Comm.	Max.	End	Max. Amp.	Remarks
	h m s	h m s	h m s	h m s	h m s	μ	
April	1721 01 03	21 06 43	21 15 27	21 23 43		29	3,870 km. Probably S. Mexico.
"	30 7 29 00	7 36 00	7 53 12	8 00 30		29	5,320 km.
May	1810 28 44		10 29 24	10 30 24	10 34 08	7	360 km.
"	20		4 22 30	4 23 34		6	

ASTRONOMICAL NOTES

A Study of Certain Nebulae for Evidences of Polarization Effects.

The spiral nebulae and certain types of extended irregular nebulae present conditions which have led some astronomers to suggest that these objects may be shining by reflected light. The original source of illumination, under this hypothesis, is assumed to be in the nuclei of the spirals and in the stars within or near the extended nebulae, and the nebular materials polarize by reflection and diffusion the rays of light falling upon them. Some of the conditions which suggest the reflection hypothesis are:

1. Nearly all of the spirals have spectra closely resembling the spectra of yellow stars, and a few of the extended nebulae show the same types of spectra as the stars apparently involved in them.

2. A few nebulae which involve stars known to be variable have spectra of the same types as the stars, and these nebulae also vary in brightness and apparent form. It is postulated that these nebulae receive their light in whole or in large measure from the variable stars within or relatively near them.

3. Those spiral nebulae which are seen edgewise or nearly so, show each a dark lane superimposed upon its image and parallel to the direction of its greatest dimension. This phenomenon, some have suggested, may possibly be explained by the reflection hypothesis. The parts or particles of such a nebula which lie nearest to us should, on this hypothesis, be bright on the faces turned away from us and toward the radiating nucleus, and relatively dark on the faces turned toward us.

A study of representative spiral and variable nebulae for evidences of polarized light is very desirable, in order to test the reflection hypothesis of the origin of their light. For this purpose

a polarigraph was designed for use in connection with the Crossley reflecting telescope. Nebulae of both types were photographed in duplicate by means of this optical combination; each nebula once with the principal plane of the analyzer coinciding with a given diameter of the object, and again with the principal plane at right angles to this position. The pairs of images were examined with the Hartmann microphotometer to detect differences of intensities along the two diameters of the nebular images.

To test the sensitiveness of the polarigraph, extensive laboratory experiments were made with different percentages of plane-polarized light. As a further test, "artificial" nebulae were illuminated with polarized light, so as to reproduce as nearly as practicable the appearance of the objects studied. As a result of the laboratory experiments, it was concluded that if as much as ten per cent. of the light in each image were plane-polarized, this property would not escape detection.

At least twelve nebulae were satisfactorily photographed and their images critically examined. In no instance was the evidence of polarization sufficient even to suspect its presence. We conclude that if some of the light coming from the nebulae under investigation is modified by reflection or scattering by small particles, the proportion of light thus polarized is less than ten per cent. of the light received from these objects.—*W. F. Meyer, in Pub. Astron. Soc. of Pacific*, June 1919.

A Theory of Novæ.

Grave objections can be urged to nearly all theories of novæ. Nova Aquilæ increased in brightness 100,000 times in six days or less. William H. Pickering asks us in "Popular Astronomy" to consider the case of a planetoid 1/100 of the Earth's mass falling upon the Sun at 400 miles per second. Its fall would furnish for six days heat equal to 50 times the Sun's normal daily emission. Moreover, the planetoid would penetrate into the Sun and there would be a tremendous explosion on account of the heat generated converting the solid planetoid into a gas and expanding the gases in the interior of the Sun, scattering the photosphere in all directions. If the enlarged photosphere presented 6,000 times the original surface, its

radius would be 33,000,000 miles. To increase to this size at parabolic velocity would require 1.6 days. But the nova took longer than this to come to maximum, so the velocity of projection must have been a little less. The enormous increase of light of a nova is due to the stored energy of the star and its enormous increase of surface rather than to the direct effect of the collision. What evidence have we that such planetoids exist? Such bodies may be more numerous near the Galaxy, where novæ generally appear. No such body can have fallen into the Sun for 100,000,000 years, but at the beginning of this epoch the Sun may have been near the Milky Way, and may have picked up the asteroids, and perhaps even the terrestrial planets themselves.—*Journal British Astronomical Association*, May, 1919.

Unification of Civil and Astronomical Time.

It has been agreed between the United States, Great Britain and France that, commencing January 1, 1925, the astronomical day shall commence, like the civil day, at midnight.—*Nature*, June 26, 1919.

E. Picard, B. Baillaud and M. Ferrie, before a meeting of the Academy of Sciences, Paris, June the 2nd, presented a project of the Bureau des Longitudes relating to the determination of a network of longitudes and latitudes all over the world. Three points are suggested: Paris, Shanghai, and a point near San Francisco. The differences of longitude are to be determined by comparisons between pendulums using wireless signals. The precision attainable should be of the order of 0.01 sec. of time. Greenwich and a point in New Zealand are suggested as additional points on the chain. —*Nature*, June 22, 1919.

The Nitrogen Atom a Compound.

Recent experiments with the alpha ray, originally detected by Rutherford and Dorn, have led to a discovery that nitrogen, which was first isolated in 1772 by D. Rutherford, and has for a century and a half been regarded and treated as an element, with an atomic weight of 14, is now suspected to be, not an element at

all, but a compound of hydrogen and helium: the helium forming the central sun or nucleus of the system, the hydrogen nuclei appearing as satellites. The combining weight of 14 is explained as due to a central nucleus of three helium nuclei, each of mass 4, the remaining two being accounted for by the hydrogen satellites. It is an interesting coincidence that Dr. Dalton, according to the now accepted account, was first led to his ideas of the atomic structure of matter by a study of the physical properties of the atmosphere. Sir Ernest Rutherford, by experiments on the same gases, now sees in each of Dalton's atoms of nitrogen an atomic system in which two distinct elements play a part, while nitrogen itself, as an element, is apparently to disappear altogether.—*English Mechanic and World of Science*, June 13, 1919.

A Complaint from the Southern Hemisphere.

Mr. C. H. Tripp, of Timaru, N.Z., writes to the British Astronomical Association to complain of the common practice of ignoring the southern hemisphere in certain statements commonly found in books on astronomy. For example, we constantly find views of the sun, moon, planets and constellations, labeled "as seen with an inverting telescope". It would be proper to add the words "in the northern hemisphere", since in the southern all these objects are seen upside down, as compared with the northern view of them, and the inverting telescope restores them to the positions in which they are seen with the naked eye in northerly latitudes. Another common error, says Mr. Tripp, is to describe the sun as always seeming to move in the direction of the hand of a watch. In the southern hemisphere the sun's apparent movement is just the opposite. He states that even experienced instrument-makers become confused on such subjects and send to southern astronomers equatorial mountings for telescopes with the right ascension circles reading the wrong way round. In one case a price-list of turbines contained particular instructions to purchasers to state whether the turbines were required to turn the way of the sun or against the sun. This came from a firm in the northern hemisphere, and might easily lead to expensive mistakes if the turbines were to be used south of the equator.—*Scientific American*, May 24, 1918.

NOTES AND QUERIES

Communications are Invited, Especially from Amateurs. The Editor will try to Secure Answers to Queries

Query.

Distance of Double Stars.

Can you tell me the angular distances in the case of
1. The two nearer components of the triple Iota Cassiopeiae.
2. Of the two in Iota Leonis?

At present is not the latter distance greater than the former?

—F. Kerr, Alexandria, Ont.

Answer.

From Burnham's "General Catalogue of Double Stars" the following information is taken.

Iota Cassiopeiae.—Stars *A* and *B*, magnitudes 4.2, 7.1; distance (1829) 1″.86, (1905) 2″.18. Stars *A* and *C*, magnitudes 4.2, 8.1; distance (1829), 7″.63, (1905) 7″.46.

Iota Leonis.—Very slow angular motion and probably binary. Magnitudes 3.9, 7.1. Distance, (1832) 2″.19, (1903) 2″.56 and slowly diminishing. Now about 2″.52.

RECENT ASTRONOMICAL APPOINTMENTS

Mr. W. E. Harper, M.A., for over ten years on the staff of the Dominion Observatory at Ottawa, was recently transferred to the new Astrophysical Observatory, at Victoria, B.C. To the same observatory has also been appointed Capt. H. H. Plaskett, B.A., who, since the armistice, has been studying at the Imperial College of Science, London, under Professor Fowler. Mr. E. A. Hodgson, M.A., has resigned his position as seismologist at the Ottawa observatory in older to enter the teaching profession. To this institution Mr. J. P. Henderson, M.A., has been appointed as assistant astronomer. Mr. Henderson has been acting as assistant in Astronomy at the University of Toronto for the last four years. The present writer extends to each of the above men his good wishes for distinguished success in his future work.

Globular Lightning.

The phenomenon of Globular Lightning is rarely seen and there is some mystery regarding its true nature. In the first issue (1907) of this Journal a case was reported from Niagara Falls, and last year Mr. Tanton of the Canadian Geological Survey reported another, though somewhat different, example. In "Nature" for June 12, 1919, is reported the observation of two "balls" as seen by G. Gilmore, a research student in University College, Dublin. Mr. Gilmore is studying the electric charge on rain, and is well qualified to report on the phenomenon. Two others claimed to have seen luminous balls during the same storm but their times did not agree and their descriptions were vague. It is certainly remarkable that so many examples of this type of lightning were seen during this storm.

Mr. Gilmore's description is as follows:

On the night of May 14 a thunderstorm took place over Dublin. A shower of rain fell after 9 p.m., but between about 9.25 and 9.40 there was practically no rain, only a few drops falling. At about 9.50 I went outside, and when I had gone about two steps from the door I suddenly saw a luminous ball apparently lying in the middle of the street. It remained stationary for a very brief interval—perhaps a second—and then vanished, a loud peal of thunder occurring at the same time, The ball appeared to be about 18 in. in diameter, and was of a blue colour, with two protuberances of a yellow colour projecting from the upper quadrants. It left no trace on the roadway. The street is about eight yards wide from footpath to footpath, with houses on both sides, the total distance across the street between the houses being about twenty yards. There are no tram-lines on the street. When I observed the ball its distance from me was about ten yards. The thunder was heard just at the disappearance of the ball, but the sound seemed to come from overhead rather than from the place where the ball was. This was the first peal of thunder that I heard, and there was no more thunder or lightning until after 10.15. From 10.40 onwards the thunderstorm was rather violent and the rain heavy. The rain ceased about 12 midnight, but sheet lightning continued to play over the sky. I was looking towards the north at about 12.15, where the sky was fairly clear, with small white clouds scattered over it, when I saw a yellow-coloured ball which appeared to travel a short distance and then disappear. This ball was high up in the sky, and appeared smaller than the first ball described above.

An Observatory Proposed for Toronto.

One of the outstanding needs of the city of Toronto at the present time is a first-class astronomical observatory. For many years there have been persistent requests from our citizens for the privilege of observing through a large telescope

the various bodies in the sky; the University of Toronto urgently needs facilities for practical instruction and for research in astronomy; and the Royal Astronomical Society of Canada is hampered in its work through the lack of a suitable place where it may put at the service of the public its valuable library and the instruments which it possesses.

These wants have not developed in a day, but have been felt for a decade. Early in 1914 a committee was appointed by the Astronomical Society to consider the question of obtaining an observatory, and the chief provisions of its report were the following:

1. That the city should furnish the site.

2. That the University should maintain the observatory.

3. That the Society should have accommodation for its library and its instruments.

4. That the observatory should include in its equipment a large telescope of aperture 20 inches and a smaller one of aperture 9 inches; the former to be at the disposal of the public at stated times (Saturday evenings) and the latter to be ready for use by amateurs at all times.

Let me discuss briefly these proposals. There is a suitable site included in property owned by the city on Bathurst Street, above St. Clair Avenue. It is suggested that the whole property be incorporated into the city's park system and a sufficient portion of it be allotted for the purposes of the observatory. It is intended that the building shall be architecturally fine and this, with many other features to interest the visitor, should make the park a very attractive place.

It is the duty of the University not only to give instruction in astronomy, but also to carry on a serious programme of astronomical research and thus extend the bounds of our knowledge; to do this, however, it must have the proper means. I know of no university, comparable to ours in size or importance, which does not possess a better equipment for practical astronomy. Yet it is essential, as it is only by actual observation that a living interest in the universe about us is aroused. Some may be inclined to say that astronomical investigations have slight practical application, but such criticism is due to a lack of comprehension. Astronomy has many direct practical applications, such as in determining time, in supplying fundamental information for the surveyor and the mariner, and in settling questions of chronology. Then I might refer to the extraordinary history of the gas helium which was discovered through observations at a solar eclipse; but in addition to all this, the discoveries in astronomy have powerfully influenced the development of man's intellect. It may well be placed along with good literature, good music and the fine arts. They are important factors in evolving a noble type of civilization. They extend our horizon, broaden our sympathies and make life much more worth living.

The Astronomical Society during the last thirty years has been accumulating a library which is now of considerable value; and it has acquired a number of instruments, chiefly by donation. It is anxious to secure a suitable place where these may be made available to the citizens.

But it does not require great mathematical talent or special scientific ability to enjoy many of the beauties of the universe, and experience has shown that when a suitable opportunity is offered, the people will seize it. Let me give two instances. The Lick Observatory, on Mt. Hamilton, Cal., has brought distinction to the name of its founder and to the state in which it is located. To reach it one must travel 25 miles up a mountain road, and the time and expense are considerable, yet each year about 5,000, from all parts of the world, visit it. The institution is open to the public every day, but on Saturday evenings the staff entertain the visitors and permit them to use the instruments. But a still more striking illustration is at hand. One of the best-known makers of telescope lenses and mirrors in the world is John A. Brashear, of Pittsburgh, Pa. While working in the rolling mills he made his first lens and mounted it into a telescope, and he has been trying ever since to provide opportunities for others to study the heavens. Some years ago he was chiefly instrumental in raising the funds for a splendid new observatory, and one of the features of it is a telescope continually open to the public. The number of those using the privilege is astonishing. I have been furnished with the following statistics: 1909, 1,620; 1910, 2,779; 1911, 1,817; 1912, 2,410; 1913, 2,588; 1914, 3,278; 1915, 3,941; 1916, 4,290; 1917, 3,373; 1918, 2,957. Total for 10 years, 29,023. Dr. Brashear, in a letter dated April 21 says: "May I say that, while I have been interested in scientific work for nearly half a century, and have done my best to bring the beautiful things in science to the comprehension of the laymen—yes, to the boys and girls—in lectures, etc., nothing outside of my purely educational work has given me so much pleasure as the free department of our observatory,—the realization of a dream of my later childhood? The demand is as great as ever for admission to see the beauty of God's universe, and apart from the scientific side, its high *moral* worth counts every time and all the time".

I have had some connection with the Boy Scout and Girl Guide movements and the constant demand from these active boys and girls is to view the heavenly bodies through a telescope. The teachers in our schools, as well as their pupils, are ignorant of the wonders of the universe, chiefly because they have not been introduced to them. A good observatory would be a splendid addition to the educational institutions of our city and of the province.

As I have already stated, the proposals outlined above for the establishment of an observatory were drawn up in 1914. First, they were approved by the Council of the Astronomical Society. Then they were presented to the Parks Committee and were endorsed by them. The Board of Governors of the University also expressed approval. Then the war broke out and the active campaign had to be given up. However, the Council of the Society, in order to put its proposition in more definite form secured from an eminent firm of architects sketch plans of the building. These provide for a handsome and commodious structure, well adapted to the varied needs of all parties.

With the coming of peace it was decided to revive the project, and by appointment a large and representative deputation met the Board of Control of the city on June 11. Mr. A. F. Miller, the President of the Society, explained the general

nature of the proposal and stated that Toronto was far behind many other cities in its facilities for astronomical observation and that the institution which it was hoped would be established would be of great value to the citizens as well as a special attraction for our city. The present writer then explained the project in some detail (largely as outlined in this note) and Mr. A. R. Hassard gave some personal experiences regarding a suitable site for observing. The deputation met with a favourable reception, and the plans outlined by it were highly commended by the city press.

By request of the Board of Control a committee comprising representatives from the Society and the University, met the heads of various departments of the city, interested in the site asked for, on July 9th, and drew up a brief outline of provisions for an agreement between the city, the University and the Society, and further progress is expected to be made during the summer or autumn.

I have no hesitation in saying that this is a unique opportunity for doing a great service to the entire community. The person of means who will supply this great need will confer peculiar benefit upon the University, the Astronomical Society, the teachers, their pupils, and especially the citizens generally; and at the same time he may bring lasting honour to his own name, or to that of one who may have died for his country, or possibly to that of one who was spared to return to his native land again.

C. A. C.